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# UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 7  
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## MEMORANDUM

**SUBJECT:** Screening Level Assessment of Risks from Groundwater at the Former Peoples Natural Gas Site, Dubuque, Iowa

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Superfund

This memorandum evaluates the potential human health risk from contaminated groundwater at the former Peoples Natural Gas site, located in Dubuque, Iowa. The site covers approximately 5 acres and is located approximately 500 feet west of the Mississippi River. An estimated 60,000 people obtain drinking water from municipal wells located within 3 miles of the site. Approximately 2,400 people live within a mile of the site and 21,000 people live within 3 miles. In previous investigations, volatile organic compounds, phenols, polycyclic aromatic hydrocarbons, and inorganic chemicals have been detected in groundwater at the site. Therefore, a screening level risk assessment was conducted to document the potential human health risks from contaminated groundwater. If you have any questions regarding this evaluation, please contact me at x7438.

### **Evaluation of Human Health Risks from Contaminated Groundwater at the former Peoples Natural Gas Site**

In 2003, the operation of a groundwater extraction and treatment system was terminated and the system was removed. The system was originally designed based on a northerly groundwater flow direction (as a result of FDL Foods, Inc. wells pumping). However, the current groundwater flow direction is primarily to the east-southeast towards the Mississippi River (since the time the FDL Foods pumps were shut down in 2000), except during times of high river levels when groundwater flow is reversed over a portion of the site (MWH, 2012).

Semiannual groundwater monitoring has continued at the site since the Technical Impracticability Evaluation Report was submitted in May 2006. The most recent groundwater monitoring events occurred in April and September 2011. The monitoring results indicate that the benzene and naphthalene plumes are present under much of the site in the silty sand aquifer (MWH, 2012).

To evaluate the potential human health risk from contaminated groundwater at the site, a screening level assessment was conducted. The EPA guidance (USEPA, 1989) recommends that all risk assessments be



based on the reasonable maximum exposure scenario. Therefore, for the assessment of the groundwater exposure pathway, a residential scenario was assumed to represent the Reasonable Maximum Exposure. The residential scenario assumes the use of a private well that would provide water for all domestic uses, including drinking, showering/bathing, washing clothes, etc. Additionally, it is assumed that the private well is located in the most contaminated part of the plume.

The data used in this assessment are found in the *Amendment to the May 2006 Technical Impracticability Evaluation Report* (MWH, 2012) and summarized in Table 1. Also, the data used in this assessment were limited to the last two monitoring events (i.e., April and September 2011).

Exposure point concentrations, to be used in this screening level assessment, were determined using the EPA ProUCL statistical software package (USEPA, 2010), which calculated the 95 percent upper confidence limit of the arithmetic mean for those contaminants that had sufficient data (ProUCL requires a minimum of 8 to 10 data points). Only data from wells in which concentrations exceeded the MCLs, or the Regional Screening Levels when MCLs were not available, were used in the calculation of the EPCs. For contaminants that did not have sufficient data (i.e., at least 8 to 10 data points) to calculate a 95% UCL, the EPC was determined by calculating the arithmetic mean. The EPCs, the method used to calculate the EPCs, and the monitoring well data that were used to calculate the EPCs are presented in Table 2.

Because this is a screening level evaluation, a simple comparison was made of the EPCs with the residential tapwater screening levels found in the EPA's Regional Screening Level tables (USEPA, 2012). The screening levels are tapwater concentrations that correspond to an excess individual lifetime cancer risk of  $1 \times 10^{-6}$  (i.e., 1 in 1,000,000) or a non-cancer hazard quotient of 1. Overall, the formulas, exposure parameters, and toxicity values used to derive the screening levels are consistent with the EPA risk assessment guidance (USEPA, 1991a, 1991b). The residential tapwater screening levels account for potential inhalation exposure, ingestion, and dermal contact with contaminated water. The equations for calculating excess individual lifetime cancer risks and hazard quotients are listed below.

$$\text{Cancer Risk} = (\text{EPC} \times 1 \times 10^{-6}) / \text{Tapwater Screening Level}$$

$$\text{Non-cancer Hazard Quotient} = \text{EPC} / \text{Tapwater Screening Level}$$

The results of the screening level evaluation are summarized in Table 3. The estimated excess individual lifetime cancer risks for benzene, ethylbenzene, benzo(a)pyrene, and naphthalene are significantly greater than  $1 \times 10^{-4}$ , or 1 in 10,000, as a result of domestic use of a future well in the groundwater plume. In addition, the non-cancer HQ is greater than 1 for benzene, ethylbenzene, and naphthalene for domestic use of a future well in the groundwater plume. Specifically, naphthalene presents the highest excess individual lifetime cancer risk of  $2 \times 10^{-2}$ , or 2 in 100, and non-cancer HQ of 497. These estimated risk values exceed the EPA's target cancer risk range of  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$  and non-cancer HQ of 1. Therefore, a significant human health threat exists if groundwater in the plume at the former Peoples Natural Gas site is used for domestic purposes.

It is important to reiterate that this is a screening level evaluation based on a comparison of the EPCs with the residential tapwater screening levels. In terms of uncertainty, the total excess individual lifetime cancer risk and non-cancer hazard indexes resulting from domestic use of groundwater may be higher than presented in this screening level risk assessment because risk was only determined for individual contaminants. Total risk from exposure to multiple contaminants was not evaluated in this assessment because data from different wells were used to calculate the EPC for each contaminant (e.g., different

wells were used to calculate the EPC for benzene than were used for naphthalene). As a result, an overestimation of potential health threat would likely occur if the cancer risk and hazard quotients from individual contaminants were added together.

Also, the arithmetic mean was used to determine EPCs for contaminants in circumstances when there were not enough data points to calculate UCLs using EPA's ProUCL software. As a result, it is possible that the arithmetic mean underestimates the excess individual lifetime cancer risk and hazard quotients. Finally, this evaluation assumes that chemical concentrations will remain constant over the entire 30 year exposure duration, which is unlikely to occur.

### **References**

MWH. 2012. Amendment to the May 2006 Technical Impracticability Evaluation Report, Former Peoples Natural Gas Site, Dubuque, Iowa.

U.S. EPA. 1989. Risk Assessment Guidance for Superfund, Part A. Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002.

U.S. EPA. 1991a. Risk Assessment Guidance for Superfund, Part B. Office of Research and Development, Washington, D.C. EPA/540/R-92/003.

U.S. EPA 1991b. Risk Assessment Guidance for Superfund, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. Office of Emergency and Remedial Response, Washington, D.C.

U.S. EPA. 2010. ProUCL Version 4.1 User Guide (Draft). Office of Research and Development, Washington, D.C. EPA/600/R-07/041.

U.S. EPA. 2012. Regional Screening Level Table. April 2012. Available on-line at <http://www.epa.gov/region09/superfund/prg/>.

Table 1. Groundwater data collected from the silty sand aquifer. All data are in µg/L.

Monitoring Well	Sampling Date	Benzene	Ethylbenzene	Benzo(a)pyrene	Naphthalene
MCL		5	700	0.2	NA
RSL <sup>1</sup>		0.39 c/29 n	1.3 c/670 n	0.0029 c	0.14 c/6.1 n
D-4	April 2011	1,430	1,010	ND	964 B
	September 2011	778	673	ND	214 B
D-6	April 2011	659	424	6.6	538
	September 2011	1,600	709	13.8	2,610 B
D-8	April 2011	112	25.2	ND	34.8 B
	September 2011	49.8	20.7	0.0399 J	25 B
P-112	April 2011	454	173	ND	6.63
	September 2011	151	74.6	ND	5.09 B
SE-2	April 2011	99.6	20.7	ND	3.09 B
	September 2011	112	78.9	ND	96.6 B
SS-6	April 2011	2,800	1,610	3.83	3,930 B
	September 2011	2,720	1,480	17.3	4,080 B
SS-8	April 2011	1.1	ND	ND	1.8 B
	September 2011	7.9	1.8	ND	2.5 B
SS-9	April 2011	43	2.1	ND	8.93 B
	September 2011	37	1.9	ND	13.3 B
W-118R	April 2011	26.1	ND	ND	ND
	September 2011	6.2	ND	ND	0.332 B
Wells Used in Calculation of EPC <sup>2</sup>		D-4, D-6, D-8, P-112, SE-2, SS-6, SS-8, SS-9, W-118R	D-4, D-6, SS-6	D-6, SS-6	D-4, D-6, D-8, P-112, SE-2, SS-6, SS-9
EPC		1,426 (95% UCL)	984 (mean, n=6)	10.4 (mean, n=4)	3,033 (95% UCL)

Numbers in italics exceed the MCL or RSL

c – cancer; n – non-cancer; MCL – Maximum Contaminant Level; RSL – Regional Screening Level; EPC – Exposure Point Concentration

<sup>1</sup>Screening Levels are from the April 2012 RSL Table.

<sup>2</sup>Wells that have concentrations greater than the MCL or RSL, when MCLs are not available, are used in calculating the exposure point concentration.

Table 2. Exposure Point Concentrations; methods used to calculate EPCs, and monitoring well data used to calculate the EPCs for the silty sand aquifer wells. All data are in µg/L.

Contaminant	RSL <sup>1</sup>		MCL	Wells Used in Calculating EPC <sup>2</sup>	EPC	Method to Calculate EPC
Benzene	0.39	c	5	D-4, D-6, D-8, P-112, SE-2, SS-6, SS-8, SS-9, W-118R	1,426	95% UCL
Benzene	29	n	5	D-4, D-6, D-8, P-112, SE-2, SS-6, SS-8, SS-9, W-118R	1,426	95% UCL
Ethylbenzene	1.3	c	700	D-4, D-6, SS-6	984	Arithmetic Mean (n=6)
Ethylbenzene	670	n	700	D-4, D-6, SS-6	984	Arithmetic Mean (n=6)
Benzo(a)pyrene	0.0029	c	0.2	D-6, SS-6	10.4	Arithmetic Mean (n=4)
Naphthalene <sup>3</sup>	0.14	c	NA	D-4, D-6, D-8, P-112, SE-2, SS-6, SS-9	3,033	95% UCL
Naphthalene <sup>3</sup>	6.1	n	NA	D-4, D-6, D-8, P-112, SE-2, SS-6, SS-9	3,033	95% UCL

c - cancer, n - non-cancer

MCL - maximum contaminant level

RSL - Regional Screening Level

<sup>1</sup>Screening Levels are from April 2012 RSL Table.

<sup>2</sup>Wells that have concentrations greater than the MCL are used in calculating the EPC.

<sup>3</sup>An MCL is unavailable for naphthalene; therefore, wells that have concentrations greater than the RSL are used in calculating the EPC.

Table 3. Estimated cancer risks and hazard quotients at the former Peoples Natural Gas site.

Contaminant	EPC ( $\mu\text{g/L}$ ) <sup>1</sup>	Cancer Risk	Hazard Quotient
Benzene	1,426	4E-03	49
Ethylbenzene	984	8E-04	1.5
Benzo(a)pyrene	10.1	4E-03	---
Naphthalene	3,033	2E-02	497

<sup>1</sup>Exposure point concentrations (EPCs) are based on 95% upper confidence limits (UCLs) of the arithmetic mean. If insufficient data are available to calculate 95% UCLs, then arithmetic means were calculated. In general, only data from wells in which concentrations exceeded MCLs were used in the calculation of EPCs.